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Water Filtration, Purification and Distillation

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Water Filtration, Purification and Distillation

V. Smolyakov

Translation from Russian of the article "OPRESNITELNAYA USTANOVKA" published in "Tekhnika i Vooruzhenie" no, 1965 pages 54-56, Moscow.

Technology and armament

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A distilling installation

A distilling mobile plant OPS consists of a proper distiller mounted over a chassis of the KRAZ-214 automobile (Fig.1) and of a trailer ESD-75 VS/230 power plant, which can be substituted by any source of electric power of 220 v of 50 hertz frequency and of not less than 75 kilowatt output.

The water is being distilled in two stages: at first it is converted into steam, and later is condensed. The water is being evaporated in the distiller not completely, a concentrated salt solution -- the brine remains, and it is uninterruptedly being removed (discarded), in order to reduce the sedimentation of salts deposited on the walls of the apparatus. Analogous processes occur during the deactivation of water in the OPS.

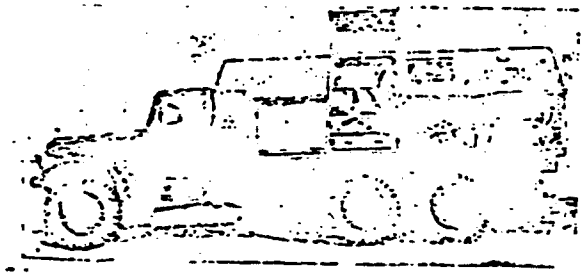

Fig. 1. The distilling plant OPS without a trailer (side trap doors are open).

A thermocompressor plant unit (Fig.2) makes it possible to utilize more fully the heat given off during the condensation of steam. The water is drawn out of the water tank by the ESN-1/1 pump and into two fabric filters inserted parallel to each other, and from them it is drawn into the magnetic filter. It is being purified of mechanical admixtures in the filters. After passing through filters, the water gets into the coil pipe of the reductor of a thermocompressor plant unit, where it cools off the oil, and then it enters two heat exchangers which are inserted parallel to each other. The condensation water runs through the first of them (the heat exchanger of the disposal) the brine performs the same part.

From the heat exchangers the water flows into the piping system and, after passing the level adjuster, it heads for the lower part of the evaporator. The evaporator consists of a reboiler (lower part), an evaporator-condenser (middle part) and of a steam collector-centrifuge (upper part). The reboiler runs on diesel fuel. At the beginning of the working operation of the plant the water in the evaporator is heated by electric heaters, built in the body of the boiler. The water evaporates in the tubes of the evaporator-condenser at the expense of the heat generated by the reboiler and a steam precompressed in the thermocompressor. The water level in the evaporator is either being automatically regulated or with the aid of a hand regulator.

The steam goes from the evaporator into a steam collector centrifuge. Finest drops of water rush in there together with the steam. These drops are detached by a separator. Later the steam goes into a thermocompressor, and from there into an evaporator-condenser under the pressure of 1.5 atm. During the compression the steam is heated again to 140-160°C, which fact impairs condensation conditions. In order to lower its temperature to 110-118°C, finely pulverized condensation water is injected into the pressure steam conduit. /55

The difference in temperatures of boiling water in tubes and of steam in the intertubular space of the evaporator-condenser signifies that the steam condenses. The heat thus emanated will be used for the evaporation of distilled water in tubes. The produced condensation water, chilled in the heat exchanger, is given out to the consumer.

During the work the plant is engaged in it would be indispensable to try to get a maximum temperature of water flowing into the reboiler, and a minimum temperature of the condensation water and of discarded brine after their running through the heat exchangers.

In the course of operational processes of the plant a portion of salts is deposited on the heating surfaces of distiller and, as a result, the heat emission deteriorates and the productive capacity drops. When the output drops

to 70-75% of the original one, the it is necessary to wash the apparatus with a 4-5 per cent nitric acid solution with subsequent neutralization performed with a 2 per cent solution of sada ash (commercial anhydrous sodium carbonate). The periodicity of the removal of the sediment depends on the content of salts in water. If, for example, the sea water is being distilled, the apparatus has to be cleaned after 150-200 hours of work, and if the fresh water undergoes a distillation process, this has to be done only after 400 hours. Smoke consuming tubes and a furnace flue of the boiler are cleaned by using wire and felt rubbing devices, after the completion of 400 working hours.

The thermocompressor and reductor work without any trouble if oil is changed periodically and the temperature of the bearings is constantly controlled, which should be from 45 to 65°C. If it exceeds 75°C the plant has to be shut down immediately, and the cause of overheating investigated and corrected.

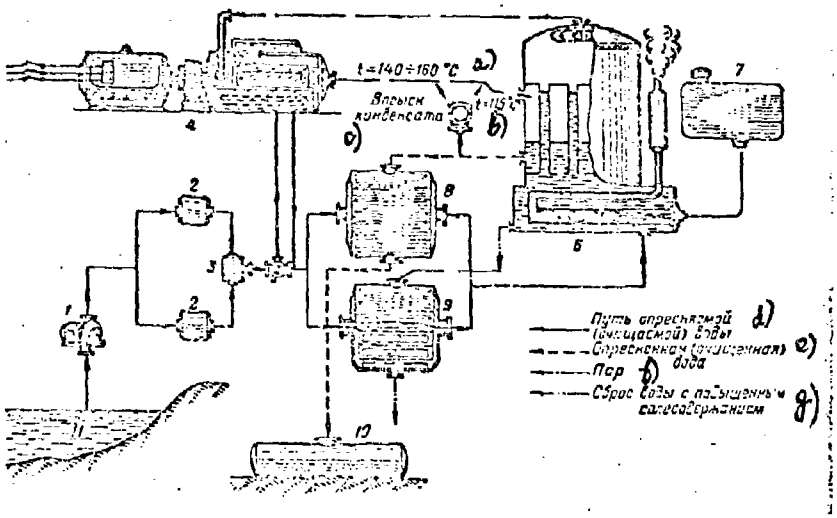

Fig. 2. The schematic drawing of distiller's operation.

a) t=140-160°C b) t=115°C c) the injection of condensation water d) the course of water being distilled e) distilled (purified water f) steam g) the disposal of water with increase saliferous content.

1) ENS1/1 pump; 2) Fabric filter; 3) Magnetic filter; 4) Thermocompressor plant unit; 5) The MSh-3A pump (injection of condensation water); 6) Evaporation; 7) Fuel tank; 8) Heat exchanger of condensation water; 9) Heat exchanger of disposal device; 10) Cubic content for purified water; 11) Water tank.

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